OMNEO Interface and OMNEO Control
Praesideo on IP

BOSCH
Invented for life

▶ **Create large Praesideo Public Address and Voice Alarm designs**
▶ **Interconnect multiple Praesideo subsystems via OMNEO IP-technology**
▶ **Use OMNEO Control to setup audio routing within a subnet**
▶ **Use OMNEO Control and ARNI-E to setup audio routing across multiple subnets**
▶ **Make redundant interconnections using dual networks or Rapid Spanning Tree Protocol**

And that is only for one audio channel in one direction. Possibly more audio channels are needed and the other subsystems can be the signal source too, then the number of links increases rapidly. Not very convenient.

Instead of using a large number of analogue audio links between subsystems, it is far more convenient to connect every subsystem to a separate digital network that carries the audio streams between the Praesideo subsystems. These streams can then be setup as multicast connections, so all subsystems receive the same audio stream from one of the subsystems. Using multiple subsystems, each one acting more or less independently, also requires a system master. The network controller of a subsystem knows which zones are present in its own subsystem and the status of these zones, about the calls that are being made or the faults that are present. But a network controller does not know what happens in the other subsystems. In Praesideo, the task of system master is performed by the PC Call Server. This is a software application running on a PC and configured to control all connected subsystems via the Open Interface of their network controllers. The Open Interface communication uses TCP/IP on an Ethernet network, which is shared between the subsystems. This demand for an Ethernet network to control the subsystems, makes it attractive to use the same network for the audio links between the subsystems. Praesideo offers different options to implement such a network, depending on the requirements: CobraNet, Dante, OMNEO and VoIP.

Introduction

Praesideo is the Bosch premium Public Address and Voice Alarm system. It is a networked system that carries up to 28 simultaneous audio streams. Most of the system devices are directly connected to the Praesideo network in a daisy chain topology, which can be looped. A single system may comprise up to 60 networked nodes, spanning a distance of more than one kilometer. To increase the system span and the number of connected devices, Praesideo can be setup using multiple subsystems. Each subsystem is a system on its own, but the subsystems can be interconnected to allow audio streams to be routed from one subsystem to the other subsystems. Although each subsystem may have up to 28 simultaneous audio streams for calls and background music (BGM), typically only a few audio connections are needed between the subsystems.

The audio connections between the subsystems can be made via analogue links between line outputs and inputs of the subsystem network controllers and/or audio expanders. In case of more than two subsystems an output of one subsystem may need to be connected to inputs in all the other subsystems, requiring split-offs or Y-cables.

Audio protocol	CobraNet	Dante	OMNEO	VoIP
Device	LBB4404/00	PRS-4OMI4	PRS-4OMI4	PRS-1AIP1
Channels	4 in / 4 out	4 in / 4 out	4 in / 4 out	1 in or 1 out
Network	Layer 2	Layer 2	Layer 2/3	Layer 2/3
Configuration tool	CobraNet Discovery	Dante Controller	OMNEO Control	Browser
Network redundancy	RSTP	RSTP	RSTP	Dual network
Audio latency	5.33 ms	1-5 ms	1-20 ms	64 ms – 8 s
Synchronized outputs	Yes	Yes	Yes	No

Dynamic and fixed channel assignment

Praesideo audio channels are dynamic, that means that a channel is only occupied by a call as long as the call lasts. As soon as the call ends, the channel is available for another call, from a different source to different destinations. In case of conflicts, channel assignment is based on priorities, where emergency calls have the highest priority and BGM has the lowest priority.

Networks for audio over Ethernet typically use fixed audio channels. That means that channels are setup between outputs and inputs of connected devices, and are assigned to that connection for as long as the configuration is not changed, regardless of whether there is audio on the channel or not.
Because of this fixed assignment, as many audio channels are needed on the network as there are signal sources that can put audio on the network, even if only one signal source is active at a time. But there can be many more receivers (destinations) on the network, receiving the same channel.

CobraNet interface

The LBB4404/00, the CobraNet interface (CIN), can simultaneously convert four channels in and four channels out between CobraNet and Praesideo. CobraNet channels are fixed channels and are setup via the CobraNet Discovery application (Disco). After this configuration, the PC can be removed. The CobraNet inputs and outputs are then available to Praesideo in the same way as line inputs and line outputs are on a Praesideo audio expander.
Praesideo (actually the Praesideo network controller) can assign a CobraNet input to one of its channels when needed, for instance to make a call via the Open Interface (PC Call station) or as an incoming BGM channel.
Praesideo can also link a Praesideo channel to a CobraNet output, as an output assigned to a zone.
A limitation of CobraNet is that only devices **in the same Ethernet subnet** can exchange audio channels. That means that you can have switches in between CINs, but no routers. The audio quality is not impaired by using CobraNet interfaces in the signal chain. CobraNet uses uncompressed PCM audio coding with a sample rate of 48 kHz and 16-bit samples. The audio delay is approximately 5 ms inside the CobraNet network, plus up to 3 ms in the sending Praesideo subsystem and up to 3 ms in the receiving Praesideo subsystem.
The next picture shows a Praesideo system consisting of three subsystems with CobraNet audio interconnections between the subsystems.
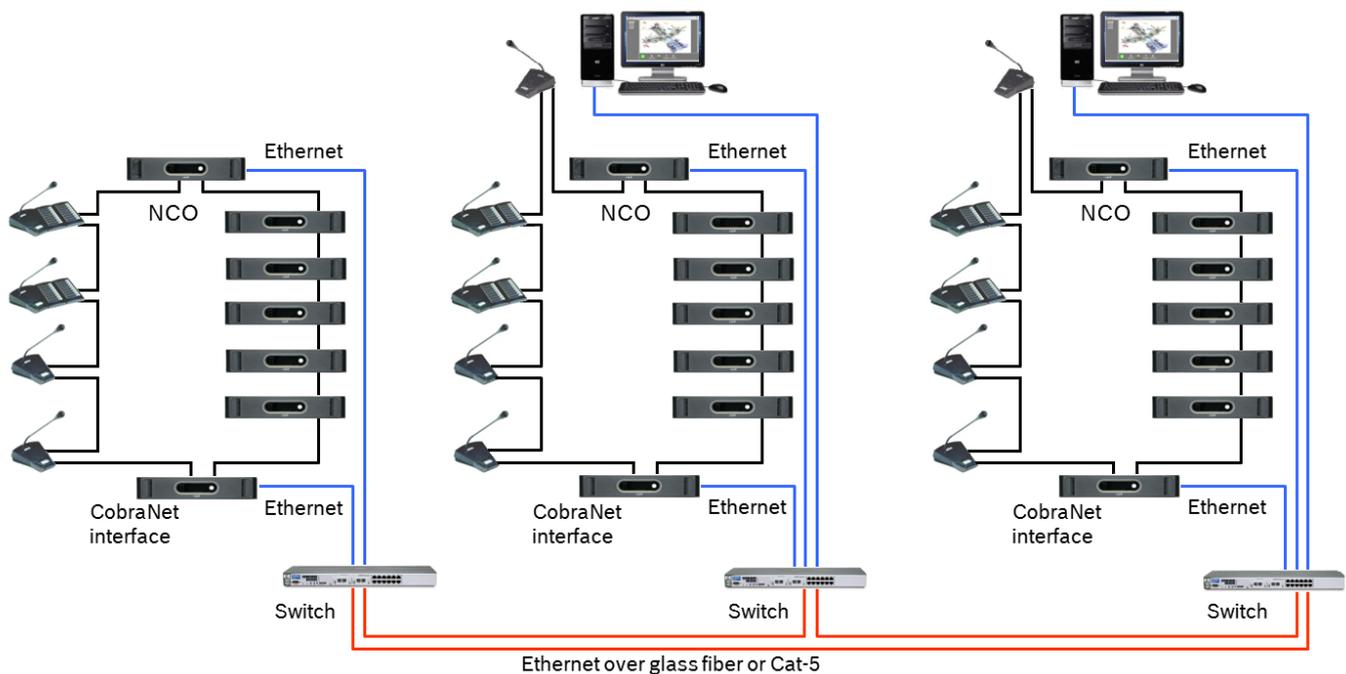
OMNEO interface

The PRS-4OMI4, the OMNEO interface or OMI, can simultaneously convert four channels in and four channels out between OMNEO and Praesideo. This is similar to what the CobraNet interface does, OMNEO is just a different set of protocols.

OMNEO incorporates Audinate's Dante audio transport protocol and OCA (Open Control Architecture), a proven system control protocol. OCA was initiated by Bosch Security Systems, developed by the OCA Alliance and released by the Audio Engineering Society (AES) as the AES70 standard. OCA is a powerful protocol to control (audio) devices and setup audio connections between devices.

The audio connections of the OMI can be setup, or configured, in two different ways, using Dante Controller or OMNEO Control. Dante Controller sets up Dante connections, OMNEO Control sets up OMNEO connections.
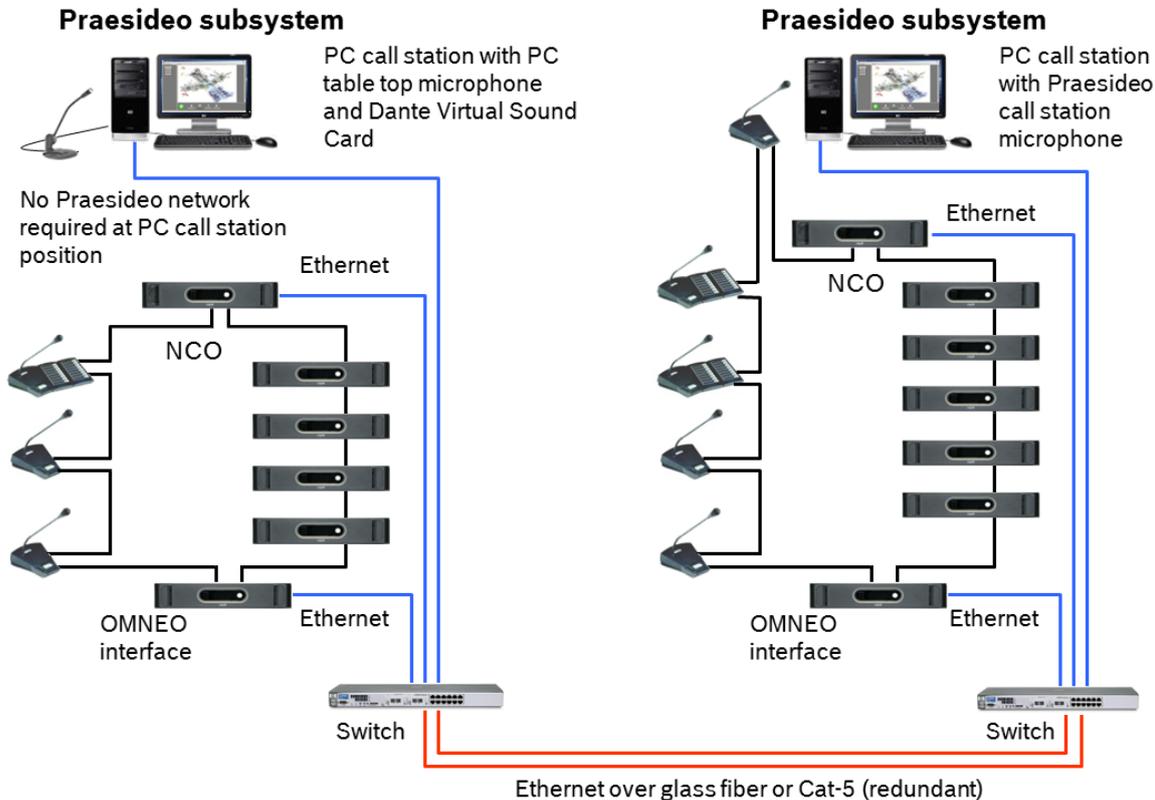
The audio quality is similar to using CobraNet, also here the sample frequency is 48 kHz and audio samples are purposely limited to 16-bit uncompressed samples to match with Praesideo.

OMNEO interface with Dante connections

Dante Controller is a PC application, developed by Audinate, the creator of Dante. Dante Controller sets up Dante audio connections, also on the OMI. These connections are label-based and can only be setup between OMNEO and Dante devices on the same subnet. So, audio connections can include Ethernet switches, but no routers. After configuration, the PC can be removed. An OMI that is power cycled will re-establish the previously configured Dante channels itself.

These Dante channels are fixed channels, just like CobraNet channels between CobraNet devices. Also the way these channels are used between Praesideo subsystems is similar to how CobraNet channels are used. A bonus for this option compared to the previous one with the CIN: you can use the PC-microphone (or PC-connected microphone) of the PC Call Station via Dante Virtual Sound card as a source for making calls. This is not possible with CobraNet, where you still have to use a Praesideo call station as microphone for a PC Call Station. Or use a microphone with integrated Dante network output, such as from Audio-Technica.

The next picture shows a Praesideo system consisting of two subsystems with Dante audio interconnections between OMNEO interfaces in the subsystems.

Praesideo subsystem — PC call station with PC table top microphone and Dante Virtual Sound Card. No Praesideo network required at PC call station position. Ethernet. NCO. OMNEO interface. Ethernet. Switch.

Praesideo subsystem — PC call station with Praesideo call station microphone. Ethernet. NCO. OMNEO interface. Ethernet. Switch.

Ethernet over glass fiber or Cat-5 (redundant)

OMNEO interface with OMNEO connections

OMNEO Control is a PC application, running under Windows and developed by Bosch Security Systems, to set up OMNEO audio connections on the OMI. These connections can be setup between OMNEO devices, but also between OMNEO devices and Dante devices, as long as the Dante devices are in the same subnet as OMNEO Control.

In this case, after configuration, the PC **cannot** be removed, because an OMI that is power cycled will not re-establish the OMNEO audio channels itself; this must be done by OMNEO Control (with locked setup). This option uses OCA for setting up connections. Dante Controller can only setup label-based connections with the advantage that they are persistent, but with the disadvantage that they need to stay within the same subnet and cannot pass routers.

Large Praesideo systems consisting of multiple subsystems, require the PC Call Server to be present in the system as a system master. The same PC that is running he PC Call Server can also be used to run OMNEO Control, so no additional equipment is needed. A second PC running OMNEO Control can also be added for redundancy. In this case the audio connections are setup using one instance of OMNEO Control, then the setup is locked. A second unlocked instance of OMNEO Control will copy the configuration of the first one automatically. Then also this one can be locked.

Although Dante Controller and OMNEO Control may be used simultaneously in the same network, this is not recommended as it may lead to confusion. An audio connection made in Dante Controller becomes also visible in OMNEO Control, where it shows up as a Dante connection. OMNEO Control can remove Dante connections and replace them for OMNEO connections. Bu to set them back to Dante connections, Dante Controller must be used.

Apart from OMNEO Control, also an ARNI-E is needed when connections across multiple subnets are needed. The ARNI-E can be in the same or another subnet.

Network latency can be configured via OMNEO Control from 1 to 20 ms. the audio outputs are fully synchronized. Audio quality is not affected because the audio channels are uncompressed 48 kHz sample rate with 24-bit word length. The occupied network bandwidth per channel is approximately 2.4 Mbps.

The two network connections of each OMNEO device can be configured in three different network modes:
- Daisy Chain
- Rapid Spanning Tree Protocol (RSTP)
- Glitch-free redundancy (not for PRS-4OMI4)

The next picture shows a Praesideo system consisting of two subsystems with OMNEO audio interconnections
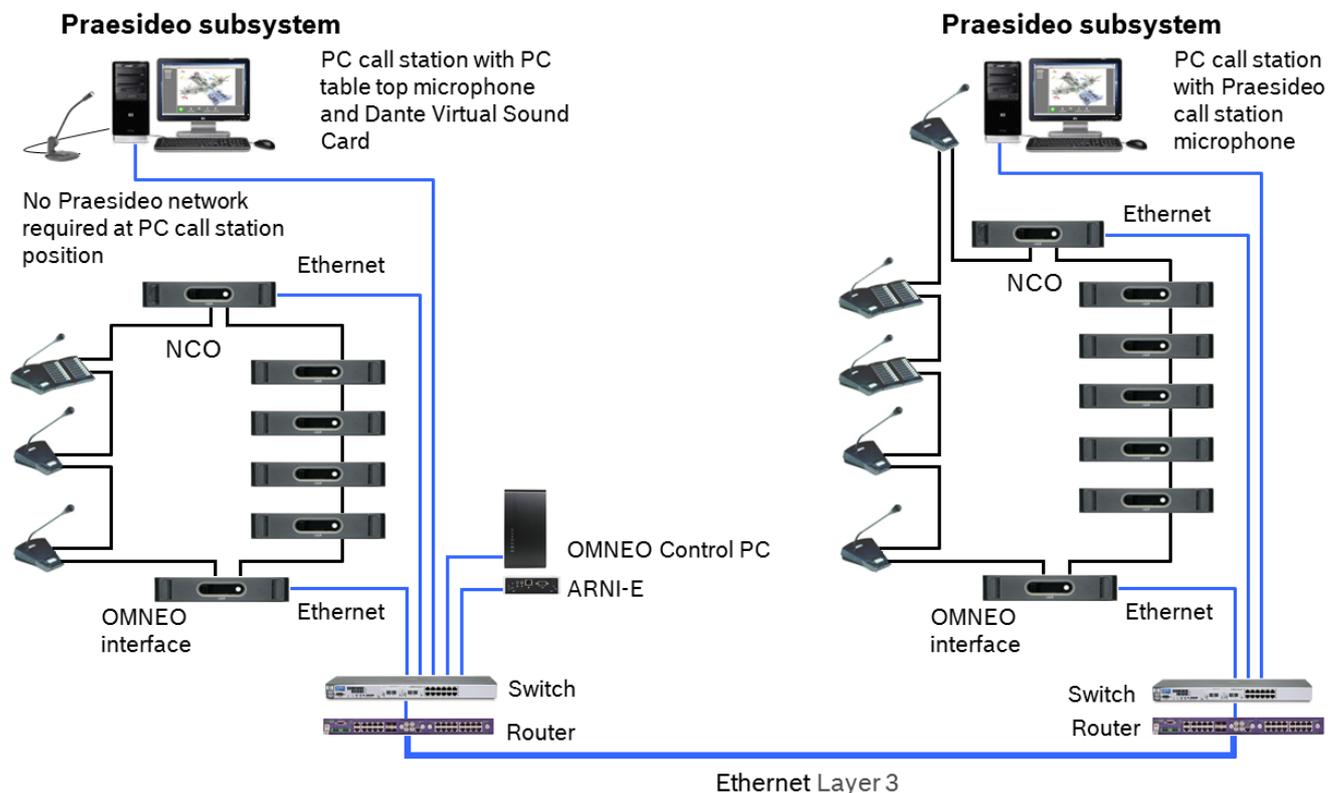
between OMNEO interfaces in two subsystems, in different subnets, connected via routers. This is a Layer-3 connection.

Especially in the subnet that does not contain the ARNI-E, use correctly configured L3 switches with built-in DHCP server. In the subnet with the ARNI-E, the ARNI-E acts as DHCP server.

ARNI

The ARNI G2 (Audio Routed Network Interface) is a small hardware device (a ruggedized industrial single board PC) that enhances the scalability of the system by its ability to act as a powerful DHCP (Dynamic Host Configuration Protocol) server, that can easily handle up to 450 devices. As a DHCP server, ARNI G2 supports one subnet when there is no DHCP server available.

It enables device discovery over different subnets (up to 10.000 devices across over 40 subnets) and synchronizes the media clocks of devices in different subnets.

Two versions of the ARNI G2 exist, ARNI-S (ARNI-Standard) and ARNI-E (ARNI-Enterprise).

With less than 128 OMNEO devices in a single subnet, no ARNI is needed. By adding an ARNI-S in a subnet, up to 450 OMNEO devices can be connected. An ARNI-E is needed for routing of audio channels across multiple subnets, with a maximum of 450 devices. In case a subnet contains more than 128 devices, also an ARNI-S is needed in that subnet.

It is possible to connect two ARNI devices in a system for redundancy.

For more information on the ARNI G2, when to use it and how, a comprehensive Technical Manual (F.01U.310.781) is available for download.

Voice over IP

In case the network bandwidth is limited, audio connections can also be established via the PRS-1AIP1 unit. With this unit, a single channel audio link (simplex or half-duplex) and 8 control signals can be transferred. This also works across Ethernet subnets (using routers). Audio inputs and outputs are analog. The audio channel uses a G7xx or MP3 codec, requiring limited data bandwidth (32 – 320 kbps). Audio delay is longer than in the previous solutions, in the order of 100ms. Setup is via a web browser and the integrated webserver in the PRS-1AIP1 itself. After configuration, the PC can be removed.

In this case there is a risk of missing pieces of audio at the beginning or end of a call, because of the relatively long audio delay through the PRS-1AIP1, which is not taken into account by the PC call station and its commands through the Open Interface (which is much faster).

Network security

The Praesideo network interfaces do not provide extensive security measures to protect the system against malicious network attacks. Therefore do not keep the network controller permanently connected to an **open** Ethernet network, but use a separate network, not accessible by others, or setup a Praesideo specific VLAN by using Ethernet switches with VLAN capabilities to partition the network into multiple broadcast domains with one domain assigned solely to Praesideo. Also the CobraNet interfaces or OMNEO interfaces must be connected to the separate network or VLAN. Because audio connections on Ethernet consume considerable network bandwidth and, unlike physically separate networks, VLANs share bandwidth, VLAN trunks may require aggregated links and/or quality of service prioritization.

Downloads

Manuals and datasheets of the products, presented in this application note, can be downloaded from www.boschsecurity.com, in the section PRS-4OMI4 OMNEO Interface of Praesideo.

Also the OMNEO Control application can be downloaded here, for free.

The application Dante Controller can be downloaded from www.audinate.com.

Ordering information

OMN-ARNIE	ARNI E OMNEO Interface	F.01U.311.136
OMN-ARNIS	ARNI S OMNEO Interface	F.01U.311.135
ARNI RM GEN-2	ARNI Rack Mount Shelf Kit G2	F.01U.311.606
PWR CORD ARNI US	ARNI Power cord - US	F.01U.316.526
PWR CORD ARNI EU	ARNI Power cord - EU	F.01U.316.527
PWR CORD ARNI UK	ARNI Power cord - UK	F.01U.316.528
PWR CORD ARNI JP	ARNI Power cord – Japan	F.01U.316.529
LBB4404/00	CobraNet interface	F.01U.126.535
PRS-4OMI4	OMNEO interface	F.01U.303.397
PRS-1AIP1	IP audio interface	F.01U.064.686